United States Patent Application

For

Method and Apparatus for Battery Reconfiguration for Radio Control

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METHOD AND APPARATUS FOR BATTERY RECONFIGURATION FOR RADIO CONTROL APPLICATION

Field of the invention:

The present invention relates to how a battery system powers both the electronics and a motor to propel a vehicle. More particularly, this invention pertains to the method and apparatus for connecting various numbers of battery cells to the battery system to optimize its performance according to the user's present needs.

Background:

Radio control (r/c) cars, boats, airplanes, submarines, etc. all have electric motors to make them move or support their movement. The more battery cells that are connected in a series configuration, the more voltage and/or speed that can be delivered to the vehicle. Connecting more battery cells in a parallel configuration allows more amperes and power to be delivered to the vehicle. A combination of series and parallel connections of the battery cells allows the user to configure an optimum power system for a vehicle in terms of weight, size, and the duration that the motor can be activated.

Since the commercialization of miniature vacuum tubes in the 1950s, hobbyists have tried to make model airplanes, boats, and cars function under remote user control by the activation of switches and knobs to control the direction and rate of speed of the model. The early r/c hobbyists all used glow fuel engines to power the vehicles because electric motors were too heavy, slow, and expensive to consider as the primary propulsion device. Batteries located in the vehicles powered electronic modules which converted radio frequency (rf) signals from the user's transmitter into specialized control signals. These signals were sent to a servo unit which turned front wheels on cars, or elevator and rudder surfaces on planes, or tillers and rudders on boats.

As battery and motor technology advanced, the r/c hobbyist could eliminate the noisy, fuel-driven engine and employ quiet electric motors to propel the vehicle. With the invention of the transistor and integrated circuits, the hobbyist could use a single set of batteries to power all the electrical circuits on a vehicle. This means that the receiver, motor speed control, servos, and drive motor all shared the same battery power source. This greatly reduced the weight of the model and simplified the number of parts a hobbyist had to buy to create a remote controlled vehicle.

Advances in electronics miniaturization and foam material processing have permitted the cost of r/c models to drop significantly. It is quite typical for a model r/c airplane flyer to have 4 to 10 fully assembled planes at the airfield during a session. Similarly, electric model car enthusiasts typically have several cars available to enter various types of races – one for each type of racing class. The same is true for boating enthusiasts. Wind sailboats, "cigar-boat" racers, and hydroplanes are available as needed for the different types of racing. All of these vehicles need a battery system. Typically a separate battery is needed for each device to match the size, weight, and power requirements of the specific vehicle in which it is used. Especially in the low-cost foam airplanes that currently exist in the r/c hobby field, the cost of batteries for each model is now equal or greater than the cost of the model's electronics. The present invention describes a method and an apparatus for quickly configuring battery cells so that they can be moved from system to system with a minimum of difficulty, and thus lowers the cost of operation of multiple vehicles.

SUMMARY OF THE INVENTION

According to one aspect of the invention, a battery system is created for r/c model vehicles that permit the rapid reconfiguration of battery cells to connect to many different vehicle systems with various serial and parallel configurations.

Other features and advantages of the present invention will become apparent from the accompanying drawings, and from the detailed description, which follows below.

BRIEF DESCRIPTION OF THE DRAWINGS

The features and advantages of the present invention are illustrated by way of example and not intended to be limited by the figures of the accompanying drawings, in which like references indicate similar elements and in which:

Fig. 1 depicts an exemplary r/c model airplane electrical wiring to demonstrate the electrical components in a brushed model airplane in accordance with prior art. The ESC is an Electronic Speed Controller that provides power to the receiver (Rx) and to the motor once the Rx gives back a signal to the ESC telling what average current to apply to the motor. The servos obtain their power from the Rx to drive their internal motors and gearboxes to the desired position.

Fig. 2A depicts a 6 cell NiMh configuration that is the current state of the art. It has been configured as in a plane of four adjacent cells on the bottom row and then two additional cells are placed in mirror image on the next row. The choice of the JST connector is a typical example of what a 6-cell r/c model airplane would use. Any of the other standard connectors (Dean's, Tamiya, Anderson Pole, AstroFlight ZeroLoss, etc.) could also be used. All r/c battery packs are either covered with tape or shrouded by heat-shrink plastic to ensure that the wires connecting the individual cells are not exposed. This is also necessary to give physical strength to the battery system so they do not disassemble in a crash.

Fig. 2B depicts a 2 cell NiMh configuration that is used to extend the 6 cell battery subsystem shown in Fig. 2A. The connector 201 from the 6 cell subsystem mates with a matching connector 202 in the 2 cell subsystem to extend the serial connections so that now 8 cells deliver their final voltage to the output connector 203.

Fig. 2C depicts the combined subsystems of Fig. 2A and Fig. 2B having more available voltage. The output connector 203 can either match the type used in Fig. 2A so that is used

in the same r/c vehicle as Fig. 2A, or it can be a different standard connector that would be employed in a different r/c vehicle. Fig. 2C depicts the battery cells as rectangular boxes for ease of drawing. When heat-shrink wrapping is applied, the combined battery cells more closely resemble rounded-edge boxes than individual cylinders. The two mating connectors 201 and 202 are a matched male-female set. It is typical for the battery to have the female connector to minimize the possibility of electrical shorting when disconnected.

Fig. 3 depicts three different configurations of the 8 cell battery system comprised of a 6 cell and a 2 cell "add-on" subsystem. The three different orientations of the 2 cell "add-on" subsystem permit the battery to be used when physical dimensions and balance point requirements change from r/c model to model.

Fig. 4 depicts a "2s3p" battery system configuration along with a switch box electrical interface and battery charger. The electrical interface allows the individual cells to be discharged and/or recharged independently.

Fig. 5 depicts a "2s3p" battery system configuration along with an embedded processor to minimize the number of individual wires going from the electrical interface to the battery system.